IMPLEMENTATION OF RELIABILITY ENGINEERING PRINCIPLES IN PISTON ROD MANUFACTURING

INTRODUCTION OF PRESENTER

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Course : Reliability Engineering (RE-539)

Institution : NED University

AGENDA

BASICS OF SHOCKS & STRUTS

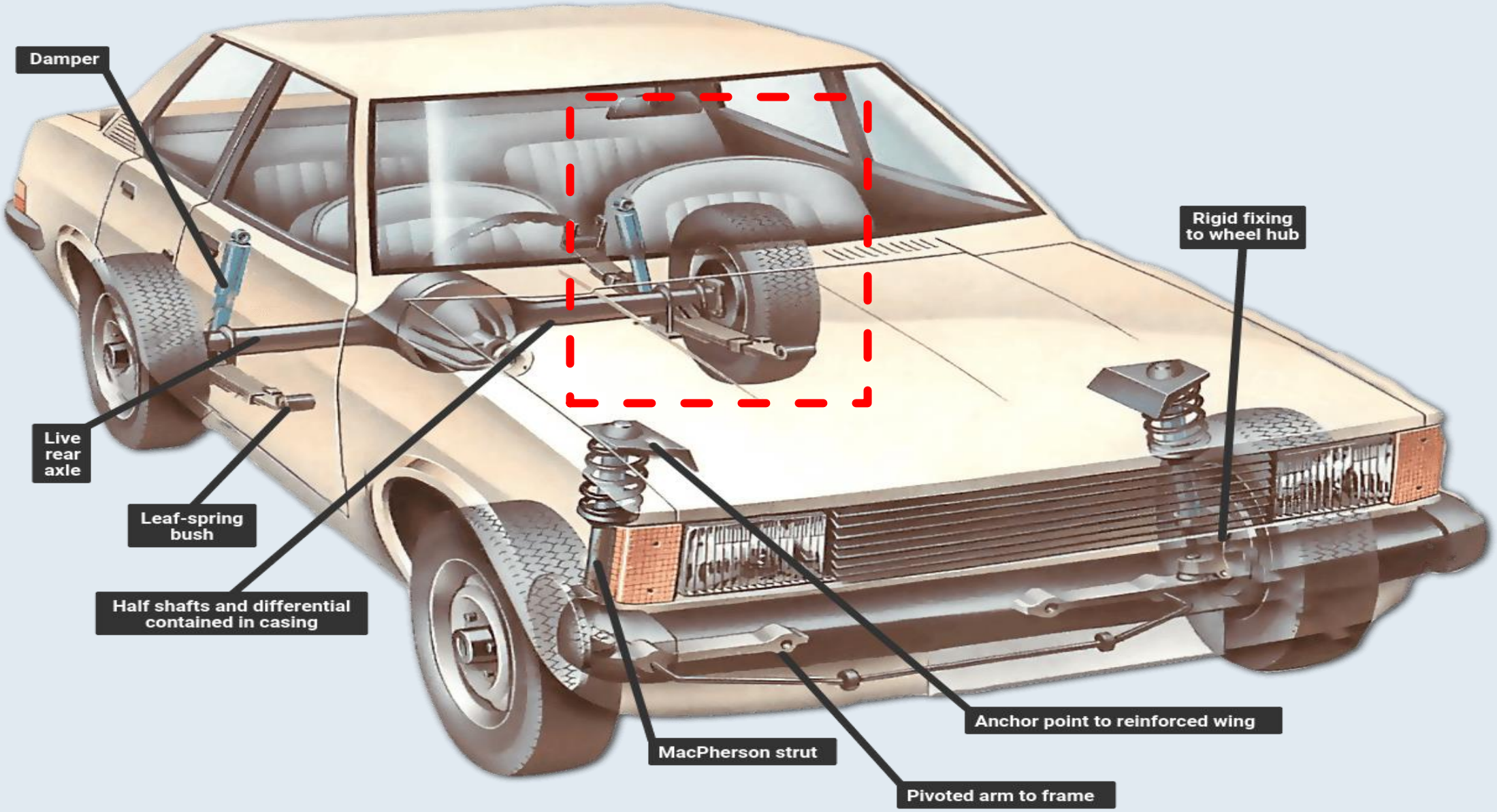
FUNCTIONS OF SUSPENSION SYSTEMS

COMPONENTS OF STRUTS

RELIABILITY IN MANUFACTURING

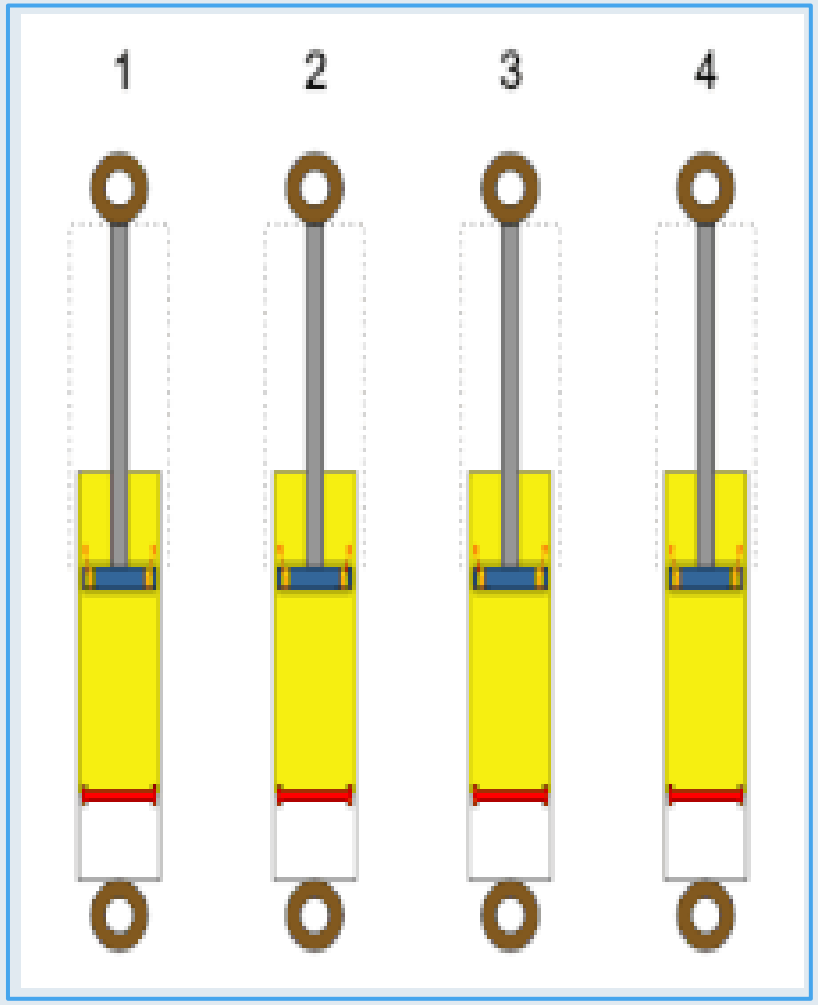
QUALITY CONTROL METHODS

CASE STUDY AND RECOMMENDATIONS


Damper
Live rear axle
Leaf-spring bush
Half shafts and differential contained in casing
Rigid fixing to wheel hub
Anchor point to reinforced wing
MacPherson strut
Pivoted arm to frame

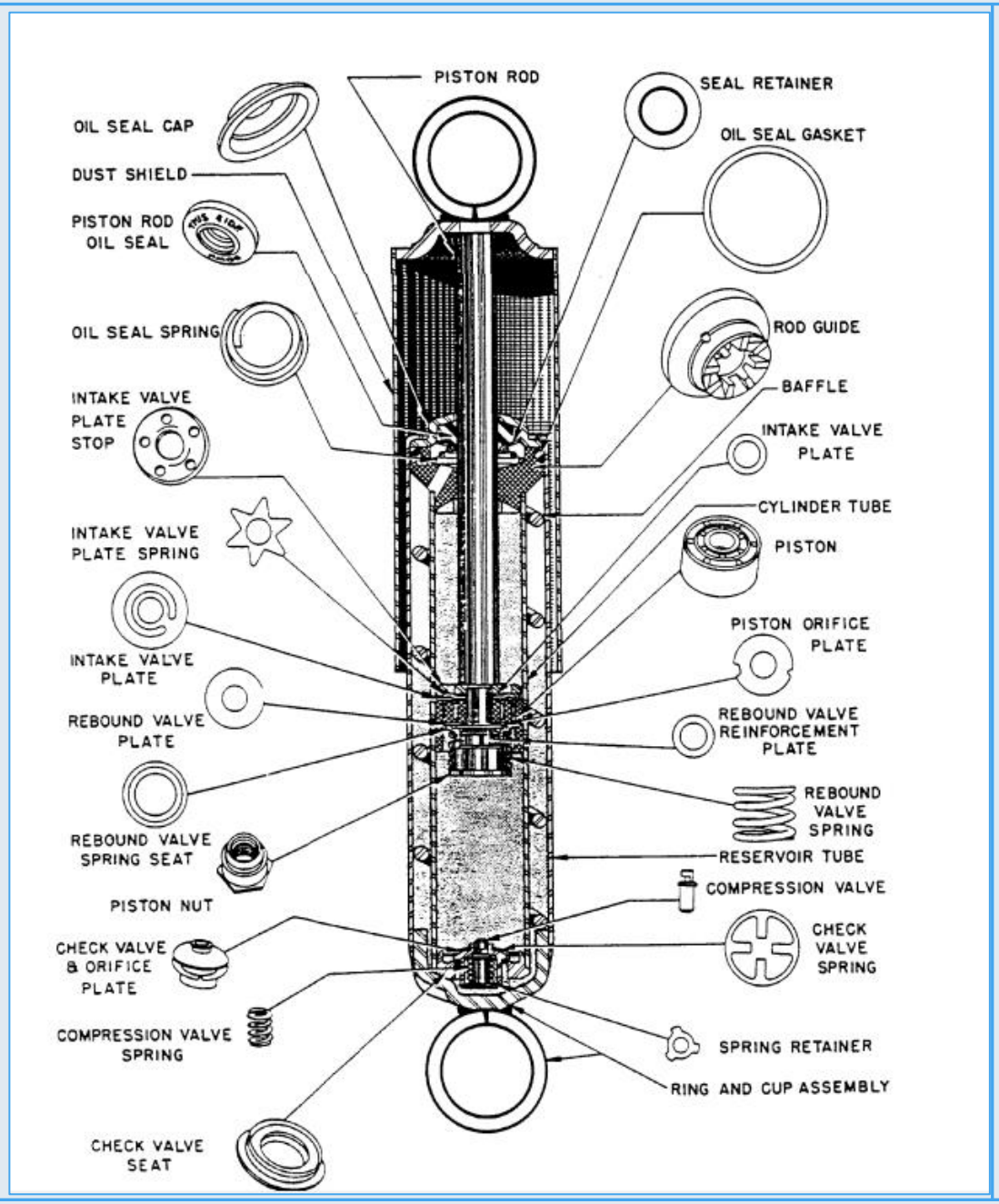
KEY FUNCTIONS

- Maximizes tire-road contact
- Provides steering stability
- Ensures comfort by absorbing shocks
- Supports vehicle weight efficiently
- Isolates the body from road vibrations



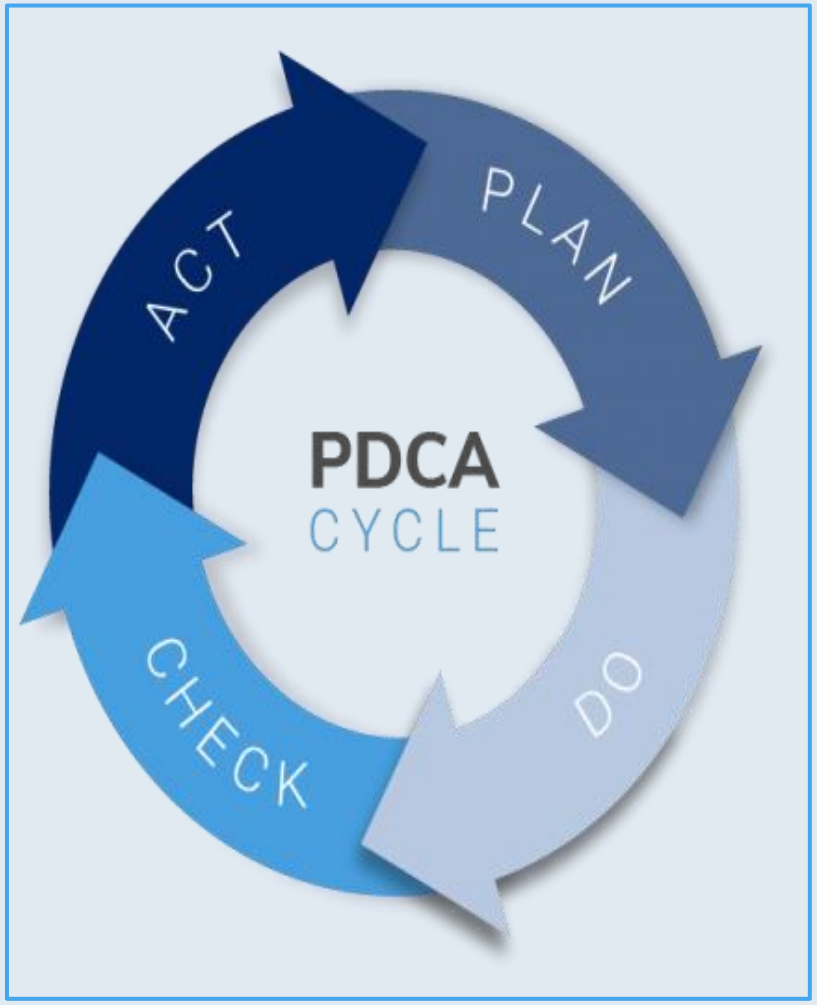
KEY PARTS

- Piston Rod
- Outer & inner Tubes
- Eye rings
- Brackets
- Valves
- Oil
- Gas (nitrogen)
- Rubber Bush



PDCA CYCLE IN IMPROVEMENT

- **Plan:**
- Identify problems or areas for improvement
- Develop objectives and processes required
- **Do:**
- Implement the plan on a small scale
- Collect data for analysis
- **Check:**
- Review and analyze the results
- Compare outcomes against objectives
- **Act:**
- If successful, implement on a larger scale
- If not, refine the plan and repeat the cycle



QUALITY CONTROL METHODS

- Dimensional and surface finish inspection
- Material testing and non-destructive testing (NDT)

QUALITY CONTROL METHODS

- Functional testing of damping force


AIL Shock Absorber Damping Force Tester
STOP
Element Drive
Position Reset
Speed Test
Report List
Part Selection
Data Graphics
Damping Force vs. Position
FORCE(N)
POSITION(mm)
OK
FINISHED
REFERENCE NOT FOUND
Max. Recoil 1
252.3
-183.2
Max. Recoil 2
70.8
Max. Comp 2
-78.1
DAMPING START M600
DAMP END M602
Gain
1.6
Temperature
25
PLC Repy M601
SERVO FRW
Stroke (mm)
50
PreSpeed
0.3
PreCycle
2
Model (less than 25 chars)
:\testdata\model\Y4J RR
Identified Number
0
PROGRAM ON
APPEND
Speed Selection
2
Speed
Cycle
Recoil
R+
R-
Comp
C+
C-
0.3
2
269
217
0.1
2
66
90
0
3
0
0
Save Filepath
d:\testdata\20241125113542
Tab Control

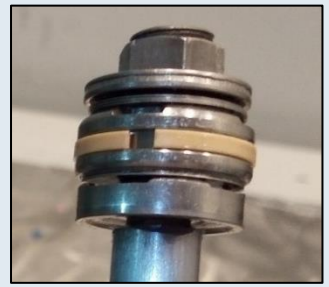
CASE STUDY OVERVIEW

- **Problem Identified :** Rear shock absorber with noise issues and low recoil
- **Details of Failure : Parts Date Code:** 9122 (2nd Week of Date : XXXXX)
- **Engraving:** AA141219B225
- **Mileage:** 1121 KM

Received Condition

DEFECTS OBSERVED

- Riveting non-conformance (Diameter and Height out of spec)
- Part missed during inspection
- Grooving tool offset during CNC machining
- Forceful insertion by assembly operator



Riveting observed NG:

Diameter = 9.387 mm (7.7 ~ 8.3 mm)

Height = 1.51 mm (0.8 ~ 1.4 mm)

PROBLEM CLARIFICATION

WHAT	• Recoil low observed in damping force testing • Riveting observed NG
WHERE	• Reported from the field warranty
WHEN	• Problem reported on Date : XXXX
WHO	• PSMCL PID Department (Warranty)
HOW	• Part handed over physically during PSMC visit @ AIL (Date : XXXXXXXXXX)

FAILURE MODE AND EFFECTS ANALYSIS (FMEA)

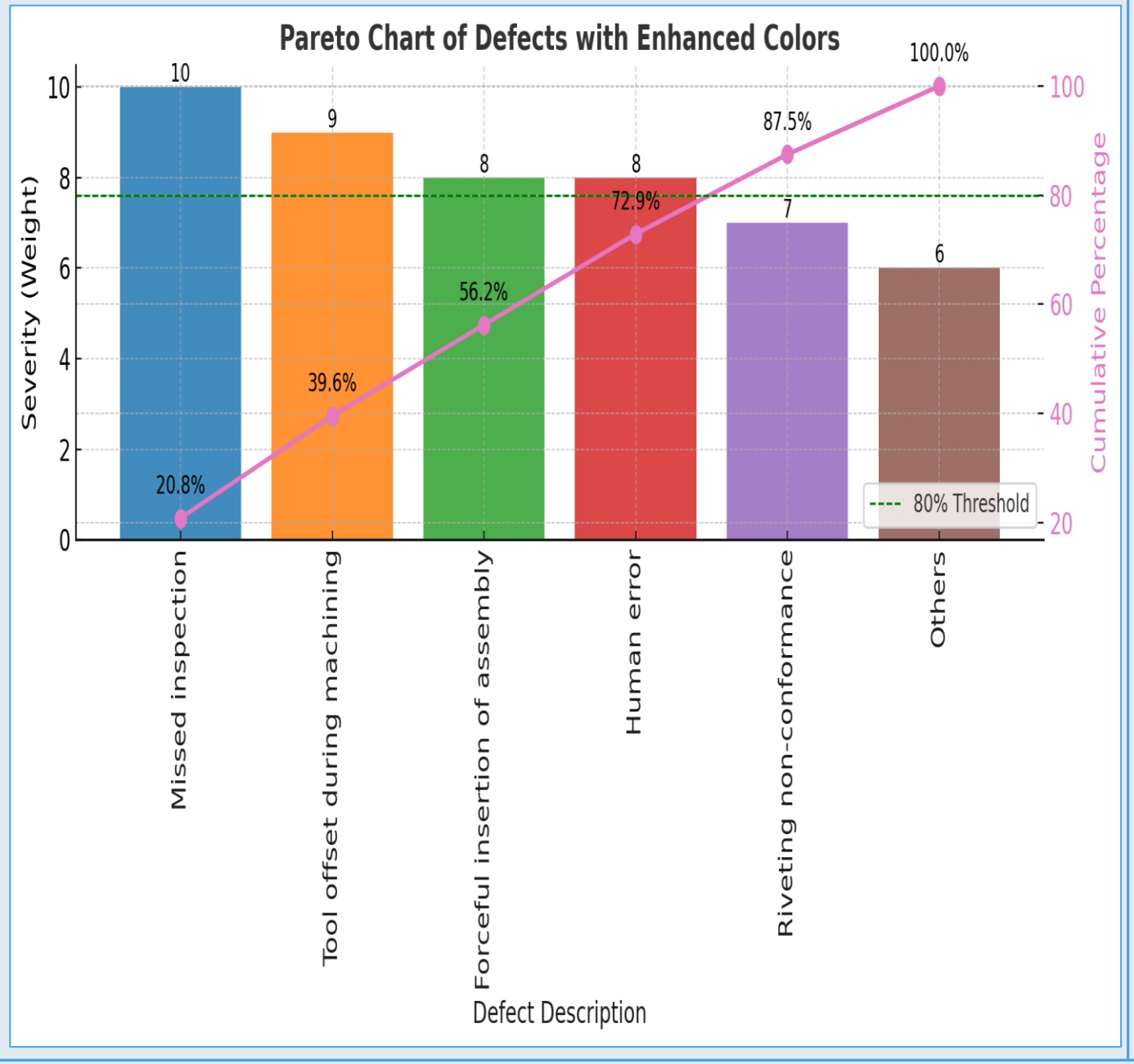
#	Failure Mode	S	O	D	RPN	Action Taken
1	Tool offset during machining	4	3	4	48	CNC calibration, operator training
2	Forceful insertion causing damage	5	2	5	50	Revised assembly process
3	Missed inspection of critical dimensions	5	3	5	75	Additional checks, new gauge

Risk Levels

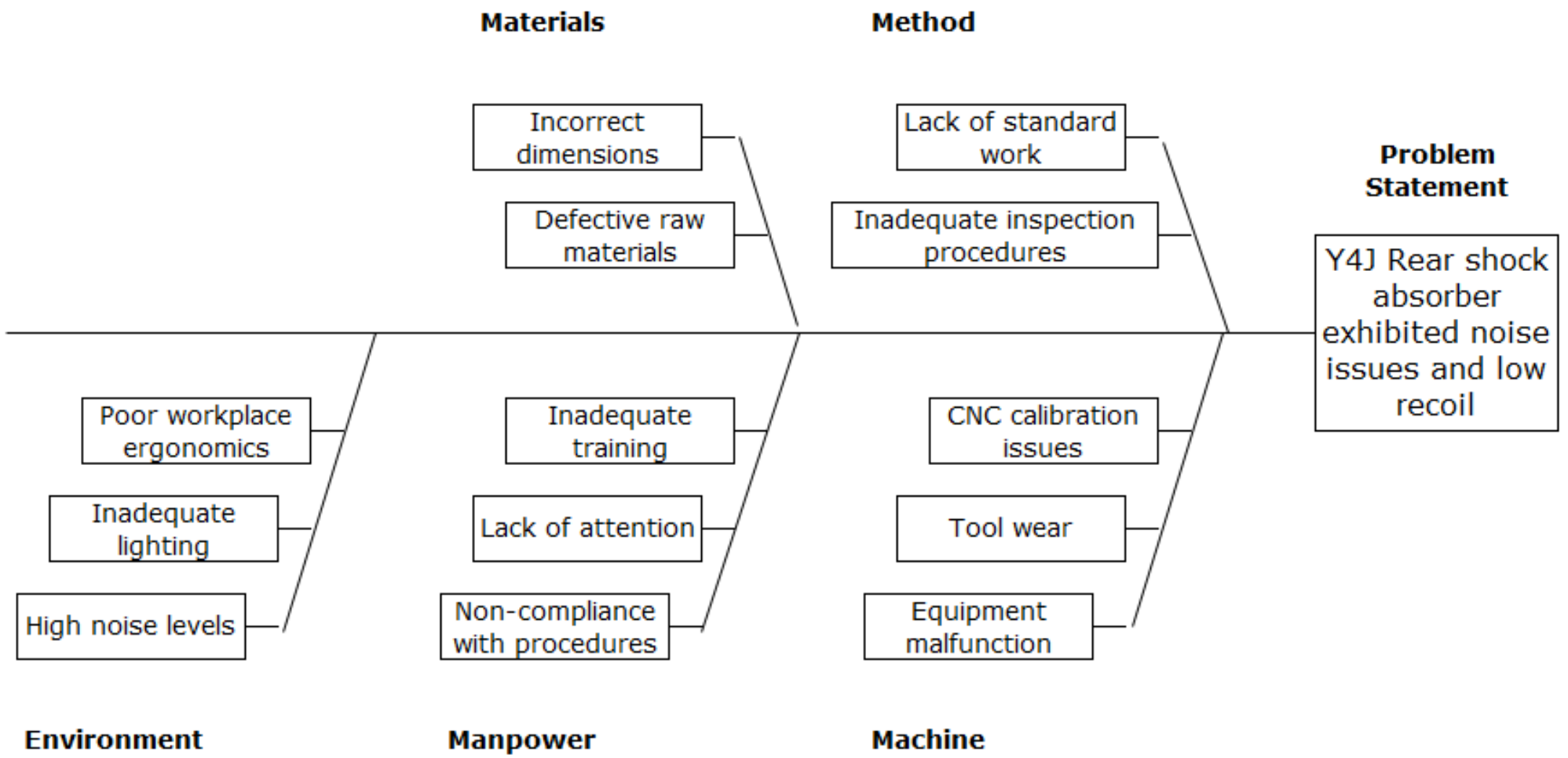
- Low (RPN 1-30), Moderate (31-75), High (>75)

PARETO ANALYSIS

Defect Code	Description	Weight
Def1	Missed inspection	10
Def2	Tool offset during machining	9
Def3	Forceful insertion of assembly	8
Def4	Riveting non-conformance	7
Def5	Human error	8
Def6	Others	6



ISHIKAWA (CAUSE AND EFFECT) DIAGRAM



POINTS OF OCCURRENCE AND DETECTION

Point of Occurrence

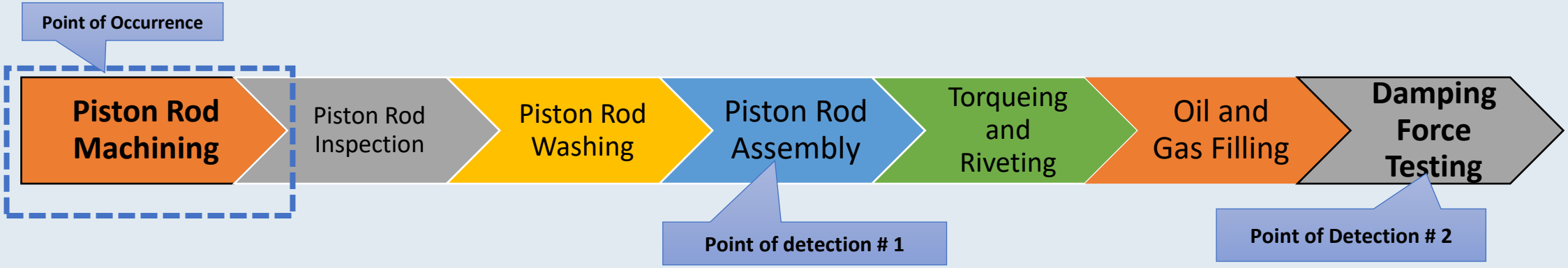
- Piston Rod Machining: Tool offset leading to incorrect groove location

Point of Detection #1

- Damping Force Testing: Recoil low observed, but part passed mistakenly

Point of Detection #2

- Final Inspection: Missed detection of machining defect



RESULTS AND IMPROVEMENTS

Quality Improvements

- Reduction in defects and warranty claims
- Enhanced product reliability

Process Enhancements

- Improved inspection procedures
- Better operator performance through training

COUNTERMEASURES IMPLEMENTED

Additional Checks

- Supervisor verification on DFT results

Gauge Fabrication

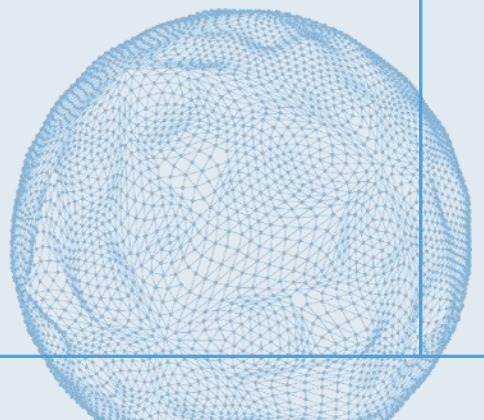
- Spacer-type gauge to detect offset rods

Operator Training

- Retraining assembly operators
- Emphasis on proper assembly techniques

CNC Calibration

- Regular maintenance and calibration schedules



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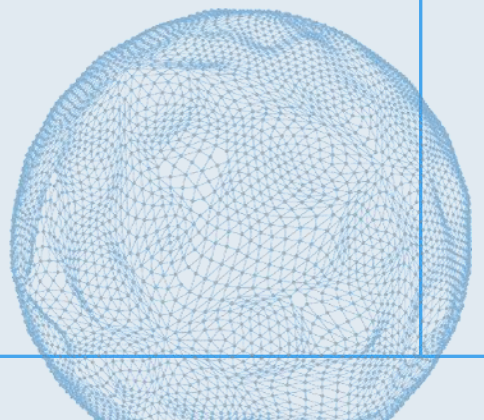
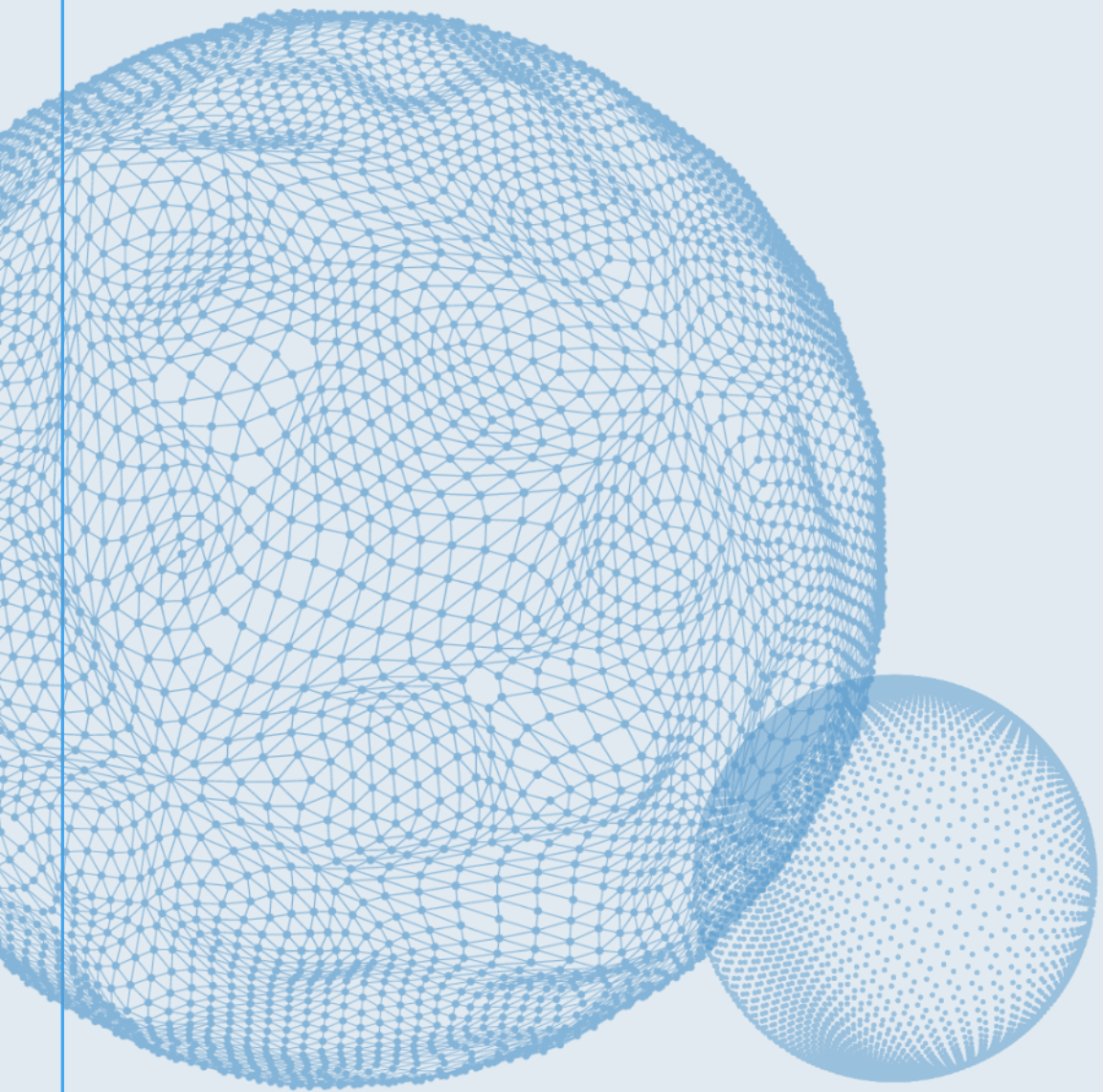


KEY RECOMMENDATIONS

- Simplify and clarify work instructions.
- Conduct regular training and refreshers.
- Implement strict calibration and maintenance schedules.



THANK YOU

QUESTIONS & ANSWERS